

A Qualitative Investigation of African American Males' Career Trajectory in Engineering: Implications for Teachers, School Counselors, and Parents

JAMES L. MOORE III

The Ohio State University

Using the grounded theory approach, this research investigation, drawing on a larger study, examined the factors that were most instrumental in influencing African American males' decisions to pursue engineering as an academic major and career choice. Using open-ended biographical questionnaires, individual interviews, and focus groups, numerous themes emerged from these data. More specifically, the central themes that had major impact on African American males' career trajectory were (a) strong interests in science, technology, engineering, and mathematics; (b) strong familial influence and encouragement; (c) strong aptitudes in science and mathematics; (d) meaningful academic experiences and relationships with school personnel; and (e) meaningful enrichment programs, opportunities, and academic experiences. Implications, based on the findings of this research, are provided for teachers, school counselors, and parents.

With the proliferation of technology, adequate preparation in science and mathematics is rapidly becoming a requisite for workplace entry and mobility in today's information, knowledge-based society (Flowers & Moore 2003b; Maton, Hrabowski, & Schmitt, 2000). Therefore, the United States has a vested interest and growing need to funnel resources into initiatives that attract and retain nontraditional populations, such as African American males, in engineering fields. "Some have suggested that the international competitive capability for technological development, knowledge production, and information exchange is heavily dependent upon much fuller development of all our national resources" (McJamerson McConnel, 1992, p. 36). Clearly, underrepresented students' academic performances at the various stages of the educational pipeline (e.g., elementary, middle, and high school) and choice of academic majors at the college level have broader social and economic implications in the United States. As a result, education and business communities have begun to develop a "renewed" interest in

and focus on the underrepresentation of ethnic minorities in engineering fields.

The underrepresentation of ethnic minorities (e.g., African Americans, Hispanic Americans, and Native Americans) working in engineering has been forecasted in both scientific and popular literature (Hill, 2001; Hrabowski & Pearson, 1993; Moore, 2000b; Moore, Flowers, Guion, Zhang, & Staten, 2004; Moore, Madison-Colmore, & Smith, 2003; Powell, 1990). Unfortunately, the underrepresentation of ethnic minorities is even more prevalent in undergraduate and graduate degree programs in science, technology, engineering, and mathematics (STEM; Graham, 1997; Hill, 2001; Hines, 1997; Hrabowski & Maton, 1995; Powell). According to the National Science Foundation (Hill, 2001), African Americans earned, in 1998, 7.6% of the awarded bachelor's degrees in science and engineering. Specifically, African American males earned 5.7% of the bachelor's degrees awarded to males in science and engineering, while African American women obtained 9.7% of the bachelor's degrees earned. With the emergence of globalism and technological advancements, the need for high-tech skills has proliferated (McJamerson McConnel, 1992). However, considerable evidence suggests that universities and colleges are not producing sufficient numbers of engineers to fill these projected high-tech positions (Babco, 2001a, 2001b; Moore, 2000b), especially for nontraditional populations (i.e., women, African Americans, Hispanic Americans, and Native Americans; Hrabowski, Maton, Greene, & Greif, 2002; Hrabowski, Maton, & Greif, 1998; Sondgeroth & Stough, 1992).

The research literature has increasingly documented the significant presence of White males in fields, such as engineering, medicine, and natural sciences (Hrabowski & Maton, 1995; McJamerson McConnel, 1992; Moore et al., 2003; Powell, 1990). According to McJamerson McConnel, "the international competitiveness of the U.S., along with associated changes in labor market demands, currently promotes heightened interests in minority students' major field choices. No longer can the U.S. depend upon White males as the only viable source of scientific and technical talent" (p. 36). Nevertheless, much of the scholarly literature concerning African American males' educational experiences has focused on their environmental and cultural disadvantages (Bailey, 2003; Cuyjet, 1998; Davis, 2003; Fries-Britt, 2000; Herndon, 2003; Moore, Ford, & Milner, 2005a), but few articles (Hrabowski et al., 1998; Greif, Hrabowski, & Maton, 2000) have examined other factors that influence their academic majors and career choices. Although some attention has been directed toward the process of choosing a college education (Freeman, 1997), there is still a dearth of research that has identified the most instrumental factors in influencing African American males' decisions to pursue engineering as an academic major and career choice.

Because a dearth of research exists on this topic, the overarching purpose of this study was to provide African American males a forum to express their experiences in their own words. Drawing on a much larger study (Moore, 2000b), this particular investigation sought to provide individuals who interact with African American males on an ongoing basis with valuable information to increase these students' interests in engineering. Toward this end, the findings of this study provided specific implications for teachers, school counselors, and parents. Similar to previous studies (Moore, 2000b; Moore, Flowers, Guion, Zhang, & Staten, 2004; Moore et al., 2005a; Moore et al., 2003), this qualitative investigation addressed significant research concerns as expressed by the American Association for the Advancement of Science (AAAS) in conjunction with the National Science Foundation (NSF; George, Neale, Van Horne, & Malcolm, 2001). More specifically, the two research bodies stated: "We need to study the reasons why able and high achieving URM [underrepresented minorities] do not enter STEM college majors or, if they enter, search for the reasons why they do not complete STEM higher education degrees or go on in higher education to pursue doctoral careers in academe" (p. 3).

METHODOLOGICAL APPROACH

This research investigation used the grounded theory approach (Glaser & Strauss, 1967; Strauss & Corbin, 1998) to examine African American males' decisions to pursue engineering as an academic major and career choice. Researchers, such as Lincoln and Guba (1985) and Scott (1995), refer to this qualitative approach as the process of collecting and analyzing data simultaneously. The underlying premise of grounded theory is to develop theoretical constructs that explain the researched phenomenon. Dey (1999) further suggested that the grounded theory approach enables constructs to emerge directly from the qualitative data, and Jorgensen (1989) asserted that grounded theory consists of "(a) comparing the data applicable to each conceptual category; (b) integrating the categories and their properties; (c) delimiting the emergent theory; and (d) writing up the theory" (p. 113). When saturation and redundancy occur, these qualitative procedures are complete.

PARTICIPANTS

The study was conducted at a large predominantly White university, located in the southeastern part of the United States. A purposeful cross-selection of 42 African American male engineering students was included in this investigation, and most of the African American male participants were juniors and seniors. The African American male participants ranged from 20 to 29 years of age, with a mean age of 23 years. The mean college grade point

average (GPA) was 2.54, and the mean high school GPA was 3.54. Scholastic Aptitude Test (SAT) composite scores ranged from 900 to 1450, with a mean of 1082.

DATA COLLECTING PROTOCOLS

Biographical questionnaires

The researcher administered biographical questionnaires to gather data on a range of relevant topics (e.g., academic interests and backgrounds, family socioeconomic situation and support, career aspirations, and childhood experiences). The biographical questionnaires rendered descriptive data that complemented the overall intent of the study.

Individual and focus group interviews

Individual and focus group interviews were the primary methods of inquiry. The two qualitative methods allowed the researcher to gain access to and tap into the many different forms of communications that the African American male participants use in their day-to-day interactions, and the two methods allowed the researcher to examine their perceptions and experiences in their entirety to develop a complete perspective of the participants (Krueger, 1988; McCracken, 1988; Morgan, 1998; Rudestam & Newton, 1992). Stated differently, the participants were able to present and explain their perceptions and experiences in their own words. The open-ended interview protocols for the individual and group interviews focused on topics similar to the biographical questionnaires; however, for this study, special emphasis was placed on the interviewing questions that examined African American males' decisions to pursue engineering as an academic major and career choice.

DATA COLLECTION PROCEDURES

After receiving approval to conduct the research by the Institutional Review Board, the researcher contacted the university's Office of Minority Affairs (OMA) for assistance in identifying and locating prospective participants. OMA provided the names, mailing addresses, telephone numbers, and e-mail addresses of potential participants. The researcher initiated contact with prospective participants through synchronous and asynchronous communications (e.g., e-mails) and followed up with telephone calls and e-mails. During the time of data collection, the researcher, an African American male, had 5 years of college counseling experience working with African American male college students. Individual interviews ranged from 30 to

60 minutes, and focus group interviews ranged from 2.5 to 3.5 hours. The individual and focus group interviews were audiotaped and transcribed.

DATA ANALYSIS PROCEDURES

After collecting these data, the researcher assembled a research team to assist with data analysis. The team comprised the researcher, two advanced doctoral students, and one assistant professor in counselor education. All members of the research team, three males and one female, were African American, and all were experienced in conceptualizing, collecting, analyzing, and writing up qualitative research. Thus, the transcripts were analyzed using the three-step sequential coding process (i.e., coding, categorizing, and applying theoretical explanations; Flowers & Moore, 2003a; Glaser & Strauss, 1967; Moore & Flowers, 2003; Strauss & Corbin, 1998). For example, the research team examined, compared, and asked questions until the data were able to be made into distinct categories and able to develop a clear illustration of the researched phenomena.

First, each research team member coded the data independently and later met as a research team to discuss the patterns or trends in these data. Second, each research team member compared and discussed his or her interpretations of categories and subcategories with the group. This process continued until each research team member agreed on the identified categories and subcategories (Miles & Huberman, 1984, 1994). Third, after collapsing categories and subcategories, the researcher sent participants a final version of data analysis as a way of soliciting input and feedback about the study's findings. None of the participants had anything to add or change to the final version of data analysis; in other words, they all were satisfied with how the data had been interpreted by the researcher.

RESULTS

In qualitative investigations, theoretical constructs are often used to explain phenomena (Glaser & Strauss, 1967; Moore et al., 2003; Strauss & Corbin, 1998). Pertaining to the African American males' decisions to pursue engineering as an academic major and career choice, the following themes emerged from the data: (a) strong interests in science, technology, engineering, and mathematics; (b) strong familial influence and encouragement; (c) strong aptitudes in science and mathematics; (d) meaningful academic experiences and relationships with school personnel; and (e) meaningful enrichment programs, opportunities, and academic experiences. These themes were identified as salient factors that influenced these students' decisions to pursue engineering.

STRONG INTERESTS IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS

Over the years, many social scientists and researchers (Hilton, Jsia, Solorzano, & Benton, 1989; Hrabowski & Maton, 1995; Hrabowski et al., 2002; Hrabowski et al., 1998; Moore, 2000b) have stressed the importance of interests in selecting an academic major, especially in STEM fields. The relationship between interests and career choice is closely linked. Furthermore, it is well documented in the research literature that certain interests that a person holds are usually the products of upbringing, environment, education, and cultural tradition (Berryman, 1983; Hrabowski et al., 2002; Hrabowski et al., 1998; Naizer, 1993).

Similar to White students, *interest* is a significant part of the career decision process for African American males (Hrabowski et al. 1998; Moore, 2000b) and females (Hrabowski et al., 2002). In the last two decades, many social scientists have attempted to explore the factors that influence students' interests in engineering. As a result, many (e.g., Berryman, 1983; Hrabowski et al., 1998; Moore, 2000b) have found that students' decisions to pursue engineering majors is highly correlated with their degree of interest in mathematics, science, technology, and engineering. Aligned with this notion, Naizer (1993) found that natural curiosity also contributed to students' interests in STEM fields. In this study, many of the African American males made reference to interests and how these interests influenced their decisions to pursue engineering as a college major and career choice. For example, one participant indicated that he became interested in engineering at an early age: "I've been interested in [engineering] ever since I was a little kid. I've always wanted to do something with highways or roads or bridges."

A second participant stated that he became interested in engineering because he loved automobiles and taking things apart: "My love for automobiles. . . . My love for taking things apart. . . . I took apart so many things as a kid. . . . I have kept that focus."

Similar to the aforementioned participant, another participant enthusiastically expressed his passion and interests for engineering:

It's like I enjoy this stuff. I enjoy working on homework. . . . I enjoy solving problems. I enjoy doing projects . . . you know I enjoy this stuff. I think the most important thing is to have an enjoyment for what you do.

A fourth participant illustrated his interests in engineering:

Well, every since I was a kid, I always wanted to build spaceships. . . . I liked to take all my remote controlled cars and stuff apart . . . so I read up on it [engineering], it sounded like something that I wanted to do.

Additionally, another male stated that engineering was a logical major for him to pursue because he had always been both good in and interested in mathematics but not English: “I’ve always been a strong math student ever since I started math back in elementary school. . . . Another thing is I hate English. I hate writing papers.”

Similar to the participant above, another male expressed his strong fascination and interests for engineering:

Just interest . . . I feel that I’m a smart guy, and I’m fascinated by any aspect of technology. I wish I could major in more than one engineering because mining mineral processing engineering isn’t the only engineering I’m interested in. I like all of them . . . I like knowing how things work, and I think that I have pretty good problem-solving skills.

STRONG FAMILIAL INFLUENCE AND ENCOURAGEMENT

Deciding on an academic major is often both exciting and stressful for students. Regardless of race or gender, many students need assistance in selecting an academic major. More often than not, assistance or support comes from parents and other family members (Greif et al., 2000; Herndon & Moore, 2002; Hrabowski et al., 2002; Hrabowski et al., 1998). Family provides guidance, support, and encouragement, especially during the time of deciding on a major.

In the research literature, a growing body of research indicates that parental and familial support has advantageous effects on students’ academic performance (Greif et al., 2000; Herndon & Moore, 2002; Moore, 2000b) and career decision process (Hrabowski et al., 2002; Hrabowski et al., 1998). For example, parents play a significant role in the career decision process for students in the STEM fields (Dick & Rollis, 1991). Aligned with this thinking, Smith and Hausfaus (1998) found that ethnic minorities perform better in mathematics and science when their parents were involved in and supportive of their education (Smith & Hausfaus, 1998).

Similar to African American females and other nontraditional populations (e.g., Native Americans and Hispanic Americans), the career paths for African American males are multifaceted. Many African American males pursue academic majors in engineering for a number of reasons—for example, interests, prestige of profession, and potential compensation. Although the reasons may vary from student to student, it is quite clear that parents and other significant family members play a critical role in the career decision process (Dick & Rollis, 1991; Hrabowski et al., 2002; Hrabowski et al., 1998; Moore, 2000b). For this study, many respondents illustrated the importance of family in their career path process (e.g., selecting engineering as an academic major). For example, one respondent stated:

He [his father] was in the Air Force, and he was an engineering technician. So math and science, he was really into it. I think he wanted me to be an engineer . . . I think that kind of had an effect on me.

Another respondent illustrated how his father influenced his decision to pursue engineering as an academic major: "I was talking to my dad about robotics and electronics . . . he told me how you could get a degree [in engineering]."

A third participant illustrated how his father influenced his academic decision: "Him [my father] not having an engineering degree but the type of job he does is basically engineering-type of work. . . . He is a real creative person. He is a big influence in my life."

A fourth suggested that his mother influenced his decision to pursue engineering:

I think that it was my mother, being a microbiologist. Ever since I was small, I wanted to be an engineer. I didn't quite know what engineering was, but I thought it sounded like a good thing to be. I started learning what an engineer was, and I was like, "okay I want to be in electrical engineering," then I got into a chemistry class, and I was like, "this chemistry stuff is kind of easy . . . okay I want to be a chemical engineer."

A fifth participant illustrated how his father's job as an electrician influenced his decision to major in engineering:

He [my father] brought forth my interests in electronics . . . by helping him out with wiring certain houses and stuff . . . putting in fuse boxes, light fixtures, stuff like that. I began to really like dealing with wiring and hands-on work and then when I got a job installing alarms, that's what solidified it for the most part.

Another African American male participant mentioned his cousins:

I had a few cousins graduated from Howard [University], and they were my role models . . . I looked up to them. They were successful, they had money, they were where I wanted to be. I thought that it [engineering] was definitely the route I needed to take, being I liked math and science in high school.

STRONG SCIENCE AND MATHEMATIC APTITUDES

Similar to African American females and other racial groups, African American males vary in their intellectual ability and learning styles; however,

what is clear about college success in engineering is that students must possess basic aptitudes in science and math (Flowers & Moore, 2003b; Hrabowski & Maton, 1995). For this study, it was found that strong science and mathematic aptitudes were instrumental in developing both the educational and career interests of the African American males in this study. For example, one participant stated, "I was sectioned off in the high math classes and that's when I began to know . . . so, those classes let me know 'hey, this might be a good area to study in.'"

Another male respondent expressed, "I've never had a great interest in math, but it was just something I was able to do with ease."

A third African American male mentioned that he decided to pursue engineering not because he was interested in the field but because he performed better in science and mathematics than in English and reading:

Early childhood years, I would say . . . probably the latter part of elementary school that I started really loving math and sciences. I don't think it was more that I loved it . . . I think it was more because I could do it better than other students in the class, and they made me feel better to do something better than they could because when it came to reading and English, I was struggling on that scale. So, I tended to push that aside and focus more on math and science.

Another African American male mentioned something similar to the third participant: "I've never had a great interest in math, but I mean . . . it was just something I was able to do . . . it was something I was able to pick up in high school."

MEANINGFUL ACADEMIC EXPERIENCES AND RELATIONSHIPS WITH SCHOOL PERSONNEL

Considerable research has focused on the intersection of social identities within different educational domains (Davis & Jordan, 1994; Graham, 1997; Hrabowski et al., 2002; Hrabowski et al., 1998). Much of the research suggests that educational professionals (Flowers, Milner, & Moore, 2003; Howard, 2003; Noguera, 2003; Sanders, 1997, 1998) respond to and interact differently with students, based on race, class, and gender. By some measures, African American females are performing better in school than their African American male counterparts (Ford, 1992; Hrabowski et al., 2002; Sanders, 1998). More specifically, many African American males have lower standardized test scores, higher dropout rates, lower participation in nonathletic extracurricular activities, and lower enrollment in advanced courses and curricula than do their White counterparts or Black females (Shaffer, Ortman, & Denbo, 2002).

Adequate academic preparation in math and science is an essential component to academic success in engineering (Hrabowski et al., 1998; Moore et al., 2004). Acquiring basic analytical and problem-solving skills in these rigorous courses is equally important (Hrabowski et al., 1998). Therefore, it is important that public schools offer academic curricula and classroom experiences in which students in general and African American male students in particular can acquire the necessary academic skills for success in engineering. The African American males' overall quality of school experiences determines, in large measure, their academic success and career paths at the different educational stages (e.g., elementary, middle, and high school). Unfortunately, African Americans too often attend schools in failing public educational systems (Moore, 2003). In many of these schools, these students are often systematically discouraged from taking advanced math and science courses (Brown Wightman, 2002). Frequently, educational professionals, such as teachers, school counselors, and parents, eliminate different career options for African American students as they progress through their elementary, secondary, and postsecondary education (Brown Wightman).

Based on the study's findings, quality school experiences and interactions with school personnel (e.g., teachers and school counselors) positively influenced the participants' educational interests and career aspirations for engineering. "Meaningful academic experiences and relationships with school personnel" was used as a theme to illustrate this finding. For example, one African American male participant stated that his elementary teacher was significant in inspiring him to pursue engineering:

I would say the first time I got interested in math was when my fifth-grade teacher thought I was very good in math, so she would give me lots of personal help. While the rest of the class was working on something, she would give me worksheets that were harder. Since I started in the fifth grade, I realized that I was good in math so I started concentrating on it more.

Another African American male participant mentioned that his technical drawing course in high school played a critical role in his decision-making process: "As I was taking the technical drawing class in high school, I was like 'yeah, I like this,' and that confirmed my decision." A third participant asserted, "I've always been pretty good at math, but I guess it was when I was in high school when we had the engineering classes that I took for a semester . . . I liked [them] so I stayed with it." Although very few participants mentioned their school counselors, one respondent credited his school counselor for influencing his decision to pursue engineering:

[My school counselor] helped us [my high school classmates] start an organization at my high school, and it was specifically aimed at getting African Americans ready for school, whether that be SATs, essays, applications, etc. She just looked at my background because I always had a strong math, science background . . . she said I had a good engineering background or potential for it.

MEANINGFUL ENRICHMENT PROGRAMS, OPPORTUNITIES, AND ACADEMIC EXPERIENCES

Many African American males experience educational journeys in public schools that lead to unwise academic decisions (Bailey, 2003; Moore, 2003; Shaffer et al., 2002) and less prestigious careers. These judgments often interact to limit postsecondary opportunities and career options. Although a variety of career possibilities and college majors are available to these students, African American students are commonly presented limited choices (Howard, 2003; Moore et al., 2004). Teachers, school counselors, and parents are all guilty of limiting the career options of African American males (Moore, 2000b; Shaffer et al., 2002). More specifically, these students are often provided poor guidance or even discouraged from taking advanced courses or participating in enrichment programs (Davis, 2003; Hrabowski et al., 1998).

Strong academic guidance, combined with taking advanced courses, has shown to be effective in increasing educational aspirations for students in general and African Americans in particular (Flowers et al., 2003; Ford & Moore, 2004; Graham, 1997; Moore et al., 2005a). In addition, social scientists have found that special programs (e.g., precollege initiatives, summer retreats) that emphasize science, technology, engineering, and mathematics can also increase students' aptitudes for and interest in these areas. For this study, many participants illustrated the importance of advanced curricula and special programs in their career decision-making process. The following theme, "meaningful enrichment programs, opportunities, and academic experiences," illustrated this point. For example, one male stated:

In like fourth and fifth grade, I was involved in the Young Astronauts program, where we met these astronauts, and they were aerospace engineers . . . so I was like "oh, I want to be an aerospace engineer," and since then engineering has been on my mind.

Another male participant asserted: "I did go to some of the PCI [precollege initiatives] programs that they had here, and they helped too. They kind of gave you an inside view of engineering." A third participant stated:

When I was in high school, I was selected to participate in a program. It was an internship or apprenticeship back with NASA . . . it taught me the basics of UNIX programming language. Also, I was a member of [another math-science program].

Another male expressed a similar point:

I think it was the program I did here with Dr. X. It was about industrial engineering, where we had to make the little trucks out of wax. I still have my program, the computer codes, the diagrams . . . back then that made me think, "I can do this, I can do industrial engineering, I can do engineering, I'm going to go to school and be an engineer." After that program, it made me confirm that I was going to be an engineer.

A sixth respondent attributed his educational interests in engineering to a special science-engineering program rather than a teacher:

Not so much a teacher . . . I know I was in an organization . . . which is an organization for minorities in engineering. We basically had speakers come in who were in college already to talk to us or we would go on field trips.

Another male participant asserted, "I was introduced to engineering, when I was in the eighth grade, through an engineering program. This is when I determined I was going to be an engineer."

Yet another respondent stated:

I think it goes back to the program in high school that really made me want to do engineering and because the whole time I was looking at medicine. I was going to do biology or something because I was thinking about being a doctor to help people but then when I took that engineering course I was like, "yeah, this is what I want to do."

DISCUSSION AND IMPLICATIONS

The five themes discussed in the previous section were found to be the primary factors that influenced the African American males' decisions to pursue engineering as an academic major and career choice. Therefore, it is reasonable to conclude that African American males who were more likely to pursue engineering as an academic major and career choice possessed strong interests in engineering; received support and

encouragement from family to explore the different possibilities in science, math, technology, and engineering; possessed high aptitudes in science and mathematics; received strong school support and encouragement from teachers and school counselors; and participated in math, science, technology, and engineering enrichment opportunities in elementary, middle, and high school.

The results of this study present viable implications for teachers, school counselors, and parents. These individuals can all play a significant role in increasing African American males' interests in engineering. Furthermore, these individuals can work collaboratively to ensure academic exposure to and career awareness about engineering, and they can also assist in encouraging African American males and exposing them to the different career opportunities in engineering. For example, educational professionals may collaborate with parents and other individuals in the community to create career awareness programs that focus on the different careers available to students in engineering. In addition, teachers can collaborate with school counselors and parents to make sure that students are taking academic courses (e.g., chemistry, biology, and algebra) expected of engineering majors.

TEACHERS

PEDAGOGY AND ENCOURAGEMENT

Teachers play a critical role in the educational process for African American males, particularly those who are interested in engineering. In classroom settings, it is important that teachers use and develop pedagogical strategies that increase educational and career aspirations for African American students (Flowers et al., 2003; Ford & Moore, 2004; Ford, Moore, & Milner, 2005b). For example, Bartz and Mathews (2001) recommended that teachers

- (a) demonstrate the relationship between schoolwork and careers by using vocational, career, and other job-related examples in their classroom work,
- (b) ascertain what students' interests are and relate those interests to possible vocations or careers,
- (c) stress the acquisition of skills needed to master prerequisites for specific vocations or careers,
- (d) point out the relationship between success in school and success in work, and
- (e) assure students that everyone has attributes that, properly coupled with training and aspirations, can lead to a successful and rewarding career (p. 36).

To increase educational aspirations, particularly in engineering, many educational researchers have also noted that teachers need to

understand how different pedagogical practices both positively and negatively impact educational and career aspirations for African American males (Flowers et al., 2003; Ford & Moore, 2004). Stated differently, it is important that teachers understand how teacher-student interactions, culturally relevant pedagogy, and advanced curriculum affect career aspirations for these students and others (Ford & Moore, 2004; Ford, Moore, & Harmon, 2005b; Moore et al., 2005b). Perhaps even more appropriate, teachers need to cover content in their courses that is expected of engineering college students. The more students are exposed to the rigors of science and mathematics, the more likely they will become interested in engineering as a major (Hrabowski et al., 1998; Moore et al., 2004). It is clear that teachers have a number of opportunities to positively interact with students. Arguably, these educational professionals have more opportunities to positively influence African American male students than any other educational professionals.

According to the research literature, many educational researchers (e.g., Howard, 2003; Moore et al., 2003) have found that positive encouragement and reinforcement of students' academic potential can increase their educational aspirations and academic outcomes. Howard found this to be especially true for African American students. Therefore, when positive encouragement is absent from the classroom, African American students' school outcomes tend to be negatively influenced.

Flowers et al. (2003) also found, using a national representative sample, that African American students' perceptions of how teachers perceived them had a profound impact on their educational aspirations. With this in mind, it is essential that teachers are cognizant of how their verbal and nonverbal communication with African American students may negatively impact their educational aspirations. When teachers create learning environments in which students are encouraged and supported, they usually are more engaged and motivated to learn difficult content (Ford, 1996; Ford & Moore, 2004; Moore et al., 2005b). Therefore, teachers need to "communicate high expectations for their students from the very beginning of their educational careers" (Flowers et al., 2003, pp. 46–47).

SCHOOL COUNSELORS

GUIDANCE AND SUPPORT

Similar to teachers, school counselors are well positioned to encourage students to pursue engineering as an academic major or career choice, especially those with high aptitudes in science and mathematics. They can provide guidance and support, and develop programs that expose students to the different career possibilities in engineering. In addition, school

counselors can offer study skills, test taking, and time management workshops to prepare these students for the rigors of postsecondary studies (Lee, 2001; Moore et al., 2005a, 2005b). These kinds of school counseling activities give students the opportunities to develop essential academic skills for both public school success and postsecondary education.

Lee (2001) specifically recommended that school counselors align their comprehensive guidance programs with the cultural realities of their students. At the different educational levels, it is not uncommon for African American males to feel unsupported (Duncan, 1999; Fries-Britt, 2000; Howard, 2003; Moore et al., 2003) and eventually disengage from the educational process (Grantham, 2004a, 2004b; Ford & Moore, 2004). These students are frequently placed in general education or special education tracks versus advanced placement (AP) or college preparatory (Bailey, 2003; Darling-Hammond, 1997) tracks. Such placements tend to limit educational and career options for African American males. Moreover, a great number of these students are ill-equipped to successfully matriculate in institutions of higher education, and even less likely in engineering and scientific majors. African American males' failures stem largely from their lack of academic preparation or exposure to advanced math (e.g., algebra I, algebra II, and geometry) and scientific courses (e.g., chemistry, biology, and physics; Atwater & Alick, 1990; Hrabowski et al., 1998; Moore et al., 2004).

As a way of avoiding these academic pitfalls, school counselors can consult with teachers and parents in monitoring the academic progress of African American males and develop academic interventions for those who need such services (Bailey, 2003; Butler, 2004; Moore et al., 2004; Moore et al., 2005a, 2005b). In addition, they can provide guidance and support with (a) academic planning and course selection; (b) postsecondary education; (c) school-to-work options; and (d) vocational information. Such activities take concerted efforts but are essential parts of successful school counseling programs (Feller, 2003; Lee, 2001; Moore et al., 2004). In addition to achieving success with African American males, Bailey recommended that educational professionals "examine their relationships with their African American male students in and outside of the school environment, incorporating strategies and/or techniques that result in academic achievement for these young men" (p. 21).

PERCEPTIONS AND ATTITUDES

In the case of school counselors, they may be seen as gatekeepers of power in school settings. They possess, in many schools, a great deal of autonomy and control over the selection process for advanced courses and curricula, special enrichment activities and programs, and prestigious scholarships and opportunities. As a result, students are often reluctant to use school

counseling services, especially students of color and low-income students (Flowers et al., 2003). With this in mind, it is important that school counselors are multiculturally competent (Constantine, 2001; Constantine & Yeh, 2001) and cognizant of how both African American males and their parents might perceive them. Again, Flowers et al. (2003) found that negative perceptions of educational professionals, such as school counselors, can hamper the educational aspirations of African American students. Therefore, it is quite likely that negative experiences with school counselors may prevent these students from using school counseling services. The more school counselors are perceived as helpful and accommodating, the more likely African American males are willing to reach out to school counselors. Lee (2001) further noted that school counselors may need to develop special provisions when working with culturally diverse students such as African American males.

SERVICES AND PROGRAMS

In school settings, school counselors create and coordinate important services for students (Moore et al., 2005a, 2005b). Although these activities are multifaceted, the promotion of career knowledge, exploration, and planning is arguably the most important for African American males. Too often, these students are inadequately exposed to different career options. As a result, it is imperative that school counselors, in consultation with other educational professionals, offer services in which students can expand their career horizons and interests. As a possible solution, Graham (1997) and Lee (2001) suggested that school counselors consider establishing shadowing experiences, mentoring programs, and other sponsored initiatives (e.g., career day) to expose students (such African American males) to nontraditional occupations (e.g., engineering).

PARENTS

INFORMATION AND SUPPORT

In addition to students, it is also important that parents are briefed on the different career options available to their children, kept updated on their children's academic progress, and reminded of the importance of strong parental involvement. Healthy school-parent relationships have been found to be beneficial to African American students' school success (Ford, 1996; Ogbu, 2003). On the contrary, the expectations of students of color and their parents often compete with the educational goals and policies of school systems (Flowers et al., 2003; Lee, 1995, 2001; Ogbu). These competing par-

adigms usually stem from school personnel's disregard for students' cultural traditions and values (Lee, 2001). For this reason, it is not unusual for African American males to develop negative attitudes toward learning (Ogbu).

Because parents have profound effects on African American students' career aspirations, it is essential that educational professionals work to establish and maintain meaningful relationships with the African American community. Lee (2001) recommended that educational professionals establish alliances with community agencies and stakeholders in these communities. He further stated that these key individuals can help bridge "cultural barriers to effective academic, career, and personal-social interventions with young people and their families" (p. 261).

African American parents have the capability to positively influence their children (arguably) more so than any other people (Herndon & Moore, 2002; Moore, 2000b, 2001). Parents can instill in their African American sons, at an early age, the importance of education (Herndon & Moore, 2001; Moore, 2001) and their expectations of academic excellence (Hrabowski et al., 1998; Moore, 2001). The more parents reinforce their expectations, the more African American males are likely to commit themselves to school—studying, learning, and making "good" grades. Parents' healthy dose of firmness, combined with encouragement, support, and ongoing follow-up, is thought to be effective in helping African American males navigate through the different levels of the educational pipeline (Hrabowski et al., 1998).

CONCLUSION

Although this study is comprehensive, the results should be interpreted with some degree of caution. Because this study possessed a primary qualitative research design, one major limitation is that it cannot be generalized to the larger African American male population. However, this study does provide initial research that attempts to explain the academic major selection and career decision process of some African American males in engineering majors. Additional research is needed to determine if the findings are generalizable to other African American males and to determine if additional factors influence African American males' decisions to pursue engineering as an academic major and career choice.

References

- Atwater, M. M., & Alick, B. (1990). Cognitive development and problem solving of Afro-American students in chemistry. *Journal of Research in Science Teaching*, 27, 157–172.
- Babco, E. L. (2001a). *Uphill climb: The status of African-Americans in science and engineering*. Retrieved July 16, 2003, from <http://ehrweb.aaas.org/mge/Reports/Report1/Uphill.html>

- Babco, E. L. (2001b). *Underrepresented minorities in engineering: A progress report*. Retrieved July 16, 2003, from http://ehrweb.aaas.org/mge/Reports/Report1/AGEP/AGEP_report.pdf
- Bailey, D. F. (2003). Preparing African-American males for postsecondary options. *The Journal of Men's Studies*, 12, 15–24.
- Bartz, D. E., & Mathews, G. S. (2001). Enhancing students' social and psychological development. *The Education Digest*, 66, 33–36.
- Berryman, S. E. (1983). *Who will do science? Trends and their causes in minority and female representations among holders of advanced degrees in science and math*. New York: Rockefeller Foundation.
- Brown Wightman, S. (2002). Hispanic students majoring in science or engineering what happened in their educational journeys. *Journal of Women and Minorities in Science and Engineering*, 8, 123–148.
- Butler, S. K. (2003). Helping urban African American high school students to excel academically: The roles of school counselors. *The High School Journal*, 87, 51–57.
- Constantine, M. G. (2001). Theoretical orientation, empathy, and multicultural counseling competence in school counselor trainees. *Professional School Counseling*, 4, 342–348.
- Constantine, M. G., & Yeh, C. J. (2001). Multicultural training, self-construals, and multicultural competence of school counselors. *Professional School Counseling*, 4, 202–207.
- Cuyjet, M. J. (1998). Recognizing and addressing marginalization among African-American college students. *College Student Affairs Journal*, 18, 64–71.
- Darling-Hammond, L. (1997). *The right to learn: A blueprint for creating schools that work*. San Francisco, CA: Jossey-Bass.
- Davis, J. E. (2003). Early schooling and academic achievement of African American males. *Urban Education*, 38, 515–537.
- Davis, J. E., & Jordan, J. E. (1994). The effects of school context, structure, and experience on African American males in middle and high school. *Journal of Negro Education*, 63, 570–587.
- Dey, I. (1999). *Grounding grounded theory: Guidelines for qualitative inquiry*. San Diego, CA: Academic Press.
- Dick, J. P., & Rollis, S. F. (1991). Factors and influences on high school students' career choices. *Journal of College Science Teaching*, 14, 20–28.
- Duncan, G. (1999). The education of adolescent Black males: Connecting self-esteem to human dignity. In L. E. Davis (Ed.), *Working with African-American males* (pp. 173–190). Thousand Oakes, CA: Sage.
- Feller, R. W. (2003). Aligning school counseling, the changing workplace, and career development assumptions. *Professional School Counseling*, 4, 262–271.
- Flowers, L. A., Milner, H. R., & Moore, J. L. III. (2003a). Effects of locus of control on African American high school seniors' educational aspirations: Implications for preservice and in-service high school teachers and counselors. *The High School Journal*, 87, 39–50.
- Flowers, L. A., & Moore, J. L. III. (2003a). Conducting qualitative research online in student affairs. *Student Affairs Online*, 4(1). Retrieved November 29, 2005, from http://www.studentaffairs.com/ejournal/Winter_2003/research.html
- Flowers, L. A., & Moore, J. L. III. (2003b). Science careers: Statistical explorations. In L. O. Flowers (Ed.), *Science careers: Personal accounts from the experts* (pp. 17–28). Lanham, MD: Scarecrow Press.
- Ford, D. Y. (1992). The American achievement ideology as perceived by urban African American students: Explorations by gender and academic program. *Urban Education*, 27, 196–211.
- Ford, D. Y. (1996). *Reversing underachievement among gifted black students: Promising practices and programs*. New York: Teachers College Press.
- Ford, D. Y., & Moore, J. L. III (2004). The achievement gap and gifted students of color: Cultural, social, and psychological factors. *Understanding our gifted*, 16, 3–7.

- Ford, D. Y., & Moore, J. L., III, & Harmon, D. A. (2005). Integrating multicultural and gifted education: A curricular framework. *Theory Into Practice, 44*, 125–137.
- Ford, D. Y., & Moore, J. L., III, & Milner, H. R. (2005). Beyond cultureblindness: A model of culture with implications for gifted education. *Roeper Review, 27*, 97–103.
- Freeman, K. (1997). Increasing African Americans' participation in higher education. *Journal of Higher Education, 68*, 523–550.
- Fries-Britt, S. (2000). Identity development of high-ability Black collegians. In M. B. Baxter Magolda (Ed.), *Teaching to promote intellectual and personal maturity: Incorporating students' worldviews and identities into the learning process* (pp. 55–65). San Francisco: Jossey-Bass.
- George, Y. S., Neale, D. S., Van Horne, V., & Malcolm, S. M. (2001). In pursuit of a diverse science, technology, engineering, and mathematics workforce: Recommended research priorities to enhance participation by underrepresented minorities. Retrieved July 16, 2003, from http://ehrweb.aaas.org/mge/Reports/Report1/AGEP/AGEP_report.pdf
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory*. Chicago: Aldine.
- Graham, L. P. (1997). *Profiles of persistence: A qualitative study of undergraduate women in engineering*. Unpublished doctoral dissertation, Virginia Polytechnic Institute and State University, Blacksburg, VA.
- Grantham, T. C. (2004a). Multicultural mentoring to increase black male representation in gifted programs. *Gifted Child Quarterly, 48*, 232–245.
- Grantham, T. C. (2004b). Rocky Jones: Case study of a high-achieving black male's motivation to participate in gifted classes. *Roeper Review, 26*, 208–215.
- Greif, G. L., Hrabowski, F. A., & Maton, K. I. (2000). African American mothers of academically successful sons: Familial influences and implications for social work. *Children & Schools, 22*, 232–245.
- Herndon, M. K. (2003). Expressions of spirituality among African-American college males. *The Journal of Men's Studies, 12*, 75–84.
- Herndon, M. K., & Moore, J. L. III (2002). African American factors for student success: Implications for families and counselors. *The Family Journal: Counseling and Therapy for Couples and Families, 10*, 322–327.
- Hill, S. T. (2001). *Science and engineering degrees, by race/ethnicity of recipients: 1990–98*. Arlington, VA: National Science Foundation, Division of Science Resources Statistics.
- Hill, S. T. (2002). *Science and engineering degrees, by race/ethnicity of recipients: 1991–2000*. (NSF 02-329). Arlington, VA: National Science Foundation, Division of Science Resources Statistics.
- Hilton, T. L., Jsia, J., Solorzano, D. G., & Benton, N. L. (1989). *Persistence in science of high-ability minority students* (Research Report No. RR-89-28). Princeton, NJ: Educational Testing Service.
- Hines, S. M. (1997). *Factors influencing persistence among African-American upperclassmen in natural science and science-related majors* (Report No. HE-030-071). Annual Meeting of the American Educational Research Association, Chicago, IL. (ERIC Documentation Reproduction Service No. ED 406 898)
- Howard, T. C. (2003). "A tug of war for own minds": African American high school students' perceptions of their academic identities and college aspirations. *The High School Journal, 87*, 4–17.
- Hrabowski, F. A. III, & Maton, K. I. (1995). Enhancing the success of African-American students in the sciences: Freshman year outcomes. *School Science and Mathematics, 95*, 19–27.
- Hrabowski, F. A., Maton, K. I., Greene, M. L., & Greif, G. L. (2002). *Overcoming the odds: Raising academically successful African American young women*. New York: Oxford University Press.
- Hrabowski, F. A., Maton, K. I., & Greif, G. L. (1998). *Beating the odds: Raising academically successful African American males*. New York: Oxford University Press.
- Hrabowski, F. A., & Pearson, W. (1993). Recruiting and retaining talented African-American males in college science and engineering. *Journal of College Science Teaching, 22*, 234–238.

- Jorgensen, D. L. (1989). *Participant observation: A methodology for human studies*. Newbury, CA: Sage.
- Krueger, R. A. (1988). *Focus groups: A practical guide for applied research*. London: Sage.
- Lee, C. C. (Ed.). (1995). *Counseling for diversity: A guide for school counselors and related professionals*. Boston: Allyn & Bacon.
- Lee, C. C. (2001). Culturally responsive school counselors and programs: Addressing the needs of all students. *Professional School Counseling, 4*, 257–261.
- Lincoln, Y., & Guba, E. (1985). *Naturalistic inquiry*. Newbury, CA: Sage.
- Maton, K. I., Hrabowski, F. A. III, & Schmitt, C. L. (2000). African American college students excelling in the sciences: College and postcollege outcomes in the Meyerhoff Scholars Program. *Journal of Research in Science Teaching, 37*, 629–654.
- McCracken, G. (1988). *The long interview*. London: Sage.
- McJamerson McConnell, E. (1992). Undergraduate academic major & minority student persistence: Individual choices, national consequences. *Equity and Excellence, 25*, 35–48.
- Miles, M. B., & Huberman, A. M. (1984). *Qualitative data analysis: A source book of new methods*. Beverly Hills, CA: Sage.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage.
- Moore, J. L. III (2000b). *The persistence of African-American males in the college of engineering at Virginia Tech*. Unpublished doctoral dissertation, Virginia Polytechnic Institute and State University, Blacksburg, VA.
- Moore, J. L., III (2001). Developing academic warriors: Things that parents, administrators, and faculty should know. In L. Jones (Ed.), *Retaining African-American faculty, administrators, and students in the 21st century and beyond: A tale of multiple paradigms* (pp. 77–90). Herndon, VA: Stylus.
- Moore, J. L. III (2003). Introduction. *The High School Journal, 87*, 1–3.
- Moore, J. L. III, & Flowers, L. A. (2003). Collecting qualitative data on the World Wide Web: A step-by-step guide for counselor educators and student affairs professionals. *Journal of Technology in Counseling, 3*(1). Retrieved November 19, 2003, from http://jtc.colstate.edu/Vol3_1/Moore/Moore.htm.
- Moore, J. L. III, Flowers, L. A., Guion, L. A., Zhang, Y., & Staten, D. L. (2004). Improving the experiences of Non-Persistent African American males in engineering programs: Implications for success. *National Association of Student Affairs Professionals Journal, 7*, 105–120.
- Moore, J. L. III, Ford, D. Y., & Milner, H. R. (2005a). Recruiting is not enough: Retaining African-American students in gifted education. *Gifted Child Quarterly, 49*, 51–67.
- Moore, J. L. III, Ford, D. Y., & Milner, H. R. (2005b). Underachievement among gifted students of color: Implications for educators. *Theory Into Practice, 44*, 167–182.
- Moore, J. L. III, Madison-Colmore, O., & Smith, D. M. (2003). The prove-them-wrong syndrome: Voices from unheard African-American males in engineering disciplines. *The Journal of Men's Studies, 12*, 61–73.
- Morgan, D. L. (1998). *The focus group guidebook*. Newbury, CA: Sage.
- Naizer, G. L. (1993). Science and engineering professors: Why did they choose science as a career? *Science & Mathematics, 93*, 321–324.
- Noguera, P. (2003). The trouble with Black boys: The role and influence of environmental and Cultural factors on the academic performance of African American males. *Urban Education, 38*, 431–459.
- Ogbu, J. U. (2003). *Black students in an affluent suburb: A study of academic disengagement*. Mahwah, NJ: Erlbaum.
- Powell, L. (1990). Factors associated with the underrepresentation of African-Americans in mathematics and science. *Journal of Negro Education, 59*, 292–298.

- Rudestam, K. E., & Newton, R. R. (1992). *Surviving your dissertation: A comprehensive guide to content and process*. London: Sage.
- Sanders, M. G. (1997). Overcoming obstacles: Academic achievement as a response to racism and discrimination. *Journal of Negro Education*, 66, 83–93.
- Sanders, M. G. (1998). The effects of school, family, and community support on the academic achievement of African-American adolescents. *Urban Education*, 33, 385–409.
- Scott, D. W. (1995). Conditions related to the academic performance of African American students at Virginia Polytechnic Institute and State University. Unpublished doctoral dissertation, Virginia Polytechnic Institute and State University, Blacksburg, VA.
- Shaffer, S., Ortman, P. E., & Denbo, S. J. (2002). The effects of racism, socioeconomic class, and gender on the academic achievement of African American students. In S. J. Denbo & L. Moore Beaulieu (Eds.), *Improving schools for African American students: A reader for educational leaders* (pp. 19–29). Springfield, IL: Charles C. Thomas.
- Smith, F. M., & Hausfaus, C. O. (1998). Relationship of family support and ethnic minority students' achievement in science and mathematics. *Science Education*, 82, 111–125.
- Sondgeroth, M. S., & Stough, L. M. (1992). Factors influencing the persistence of ethnic minority students enrolled in a college engineering program (Report No. HE-026-184). San Francisco: American Educational Research Association. (ERIC Documentation Reproduction Service No. ED353923)
- Strauss, A. L., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Newbury Park, CA: Sage.

JAMES L. MOORE III is an assistant professor in Counselor Education and is the coordinator of the School Counseling Program in the College of Education at The Ohio State University. Professor Moore also serves as an affiliated scholar for both the John Glenn Institute and Ohio Collaborative at The Ohio State University. In addition, he serves as a LASER research associate for the Center for Action Research on Urban Schools and Effective Leadership at the University of South Florida.

African-American males in contemporary American society face major challenges to their more. Diagnosable mental illnesses and related behavioral problems have risen dramatically among adolescent African-American males in recent years. African-American males in contemporary American society face major challenges to their psychological development and well-being. The lived experience of African American male educators is the topic of this qualitative phenomenological study. The intent of the research was to address and identify themes that inform and influence dialogue about this under represented population of educators. Lastly, the article concludes with implications for theory, university policymakers, and practitioners. Save to Library. Among African Americans, for example, this implies reduced trust and engagement in academic institutions and more wariness of the people seen as representing those institutions (e.g. professors, nonminority students). This pattern of reactions is likely to undermine academic success. The disconfirmation of one's expectations of negative treatment, however, may attenuate the impact of those expectations on behavior and outcomes. Decreasing discipline referrals for African American males in middle school. *AASA Journal of Scholarship & Practice*, 4 (2), 20-24. Google Scholar. Morrison, B. E., & Vaandering, D. (2012). Restorative justice: Pedagogy, praxis, and discipline. *Journal of School Violence*, 11 (2), 138-155. Article Google Scholar. Race is not neutral: A national investigation of African American and Latino disproportionality in school discipline. *School Psychology Review*, 40, 85-107. Google Scholar. Villegas, A. M., & Lucas, T. (2002). Preparing culturally responsive teachers rethinking the curriculum. *Journal of Teacher Education*, 53 (1), 20-32. Article Google Scholar. A Qualitative Investigation of African American Males' Career Trajectory in Engineering: Implications for Teachers, School Counselors, and Parents. Article. Feb 2006. *Teach coll rec*. James L. Moore III. Data from a teacher certification test were analyzed using White candidates in the reference group and African American candidates in the focal [Show full abstract] group. Smoothed and raw DIF estimates from 100 replications under seven different sample-size conditions were compared to a criterion to determine the effect of smoothing on small-sample DIF estimation. Root-mean-squared deviation and bias were used to evaluate the accuracy of DIF detection in the smoothed versus raw data conditions. "Ladson-Billings integrates scholarly research with stories of eight successful teachers in a predominantly African American school district to illustrate that the 'dream' of all teachers and parents' academic success for all children is alive and can be emulated." - Library Journal. "Here is a book filled with pride and questions that should stimulate anyone interested in improving education."